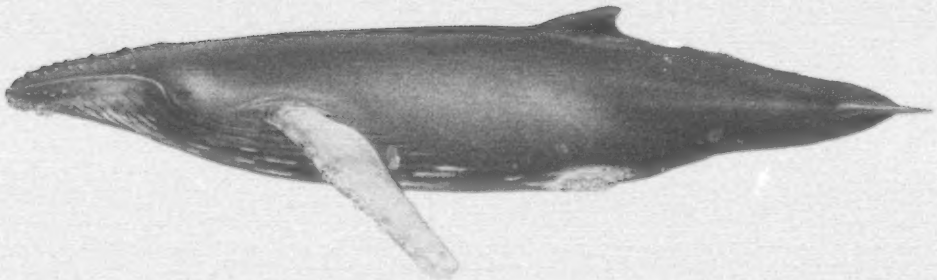
COSEWIC
Assessment and Status Report

on the

Humpback Whale
Megaptera novaeangliae

North Pacific population

in Canada



SPECIAL CONCERN
2011

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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COSEWIC
Assessment Summary

Assessment Summary – May 2011

Common name
Humpback Whale - North Pacific population

Scientific name
Megaptera novaeangliae

Status
Special Concern

Reason for designation
Although this recovering population is no longer considered to be Threatened, it is not yet secure. It was depleted by commercial whaling but has increased substantially since becoming legally protected from whaling in 1966. A basin-wide study in 2004-2006 resulted in an estimated abundance of 18,000 animals (not including first-year calves) in the North Pacific and an estimated rate of increase of 4.9 to 6.8%/year. Research conducted between 2004-06 indicated that about 2,145 whales (not including first-year calves) were present seasonally in British Columbia waters where they were increasing at around 4%/year. Current numbers are still considerably smaller than the minimum of 4,000 animals that must have been present off the west coast of Vancouver Island in 1905 given the numbers removed by whaling in the early 1900s. This population in the eastern North Pacific continues to face several threats including noise disturbance, habitat degradation (especially on the breeding grounds), entanglement in fishing gear or debris, and ship strikes.

Occurrence
Pacific Ocean

Status history
The "Western North Atlantic and North Pacific populations" were given a single designation of Threatened in April 1982. Split into two populations in April 1985 (Western North Atlantic population and North Pacific population). The North Pacific population designated Threatened in 1985. Status re-examined and confirmed in May 2003. Status re-examined and designated Special Concern in May 2011.

COSEWIC
Executive Summary

Humpback Whale
Megaptera novaeangliae

North Pacific population

Wildlife species description and significance

The Humpback Whale (*Megaptera novaeangliae*) is a baleen whale of the family Balaenopteridae. It reaches a length of 13-14 m. It is recognizable by its long pectoral flippers that are 25% of the body length, variable black and white colouration, and rich, complex songs. Its near-shore distribution and frequent acrobatic aerial displays make it a favourite species for whale watching in Canada and some other parts of the world. Also, the Humpback Whale has cultural significance to coastal First Nations in British Columbia, having been hunted for subsistence historically.

Two distinct populations of Humpback Whales are recognized in Canada and have been assessed separately by COSEWIC: the Western North Atlantic population and the North Pacific population. This assessment concerns only the North Pacific population.

Distribution

Humpback Whales have a cosmopolitan distribution and are found in tropical, temperate, and sub-polar waters. In Pacific Canada, their range extends the length of the British Columbia coast, and includes both offshore waters and inshore coastal inlets. Humpback Whales migrate from high-latitude summer feeding areas to low-latitude winter breeding and calving areas. The whales are in Canadian waters primarily for summer feeding, although they are present in low numbers throughout the year.

Habitat

Courting, mating, and calving take place mostly in warm and shallow temperate and tropical waters, whereas feeding occurs primarily at high latitudes in colder, more productive waters. British Columbia's coastal inlets and shelf waters provide productive feeding habitat, but the whales also use offshore waters during migration. Humpback Whale distribution and dive depths are closely correlated with the distribution and density of prey.

Biology

Humpback Whale breeding is strongly seasonal, and in the Pacific as a whole, courting and mating occur from approximately December to May on breeding grounds in the coastal waters of the Hawaiian Islands, Mexico, Central America, Japan, and the Philippines. Females give birth to one offspring generally every 1-5 years after a gestation period of 11-12 months. Although some calves stay with their mothers for 2 years, most are weaned at less than a year. Both sexes reach sexual maturity at 5 to 9 years of age. Average longevity for Humpback Whales is unknown, although maximum longevity is at least 48 years and probably much longer.

Population sizes and trends

Commercial whaling had seriously depleted all populations of Humpback Whales before the species was given legal protection in the North Pacific in 1966. Indirect evidence of population trend over the last three generations (i.e., since 1946) comes from catch records at the Coal Harbour whaling station on Vancouver Island that began operating in 1948. Initially (1948-1953), 20% of the catch was Humpbacks. This percentage declined to 7% from 1954 through 1959 and to only 2% from 1962 through 1965 (the station did not operate in 1960 and 1961 and it closed after the 1967 whaling season). Although no trend data are available from 1966 to the 1990s, there has been a general increase in abundance in recent years. Based on photo-identification data, the best population estimate for Humpback Whales in British Columbia waters in 2006 was 2,145 (not including first-year calves), meaning roughly 1,800 mature individuals, and the best abundance estimate for the North Pacific overall in 2006 was 18,302 (not including first-year calves). Humpback Whales in British Columbia were recently estimated to have an annual population growth rate of 4.1% (95% CI 3.4-5.4%), which is comparable to the estimate of 4.9% for the entire North Pacific.

Threats

Humpback Whales in Canadian Pacific waters are affected by a variety of threats, notably vessel strikes, entanglement in fishing gear, and disturbance or displacement due to underwater noise.

Protection, status and ranks

Humpback Whales are legally protected in most parts of their global range under the International Convention for the Regulation of Whaling and the Convention on International Trade in Endangered Species of Wild Fauna and Flora. In Canada, COSEWIC previously assessed the North Atlantic population as Threatened in 2003; they are afforded legal protection through the Marine Mammal Regulations of the *Fisheries Act* as well as the *Species at Risk Act*, under which the North Pacific population is listed as Threatened on Schedule 1. In the United States, Humpback Whales are legally protected by the *Marine Mammal Protection Act* and the species is listed as Endangered. The IUCN Red List status is Least Concern.

TECHNICAL SUMMARY

Megaptera novaeangliae
Humpback Whale
(North Pacific population)
Range of occurrence in Canada: Pacific Ocean

Rorqual à bosse
(Population du Pacifique Nord)

Demographic Information

Generation time (under pre-disturbance conditions with an assumed stable population)	21.5 yrs
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	No
Estimated percent of continuing decline in total number of mature individuals within 2 generations	No continuing decline
Estimated percent increase in total number of mature individuals over the last 3 generations (i.e., since 1942)	Unknown but assumed to have been substantial (i.e. > 50%)
Projected percent increase in total number of mature individuals over the next 3 generations.	Recent rate of increase (1992-2006) approx. 4%/year
Estimated percent increase in total number of mature individuals over any 3 generation period, over a time period including both the past and the future.	Recent rate of increase (1992-2006) approx. 4%/year
Are the causes of the decline clearly reversible, understood, and ceased?	No recent decline
Are there extreme fluctuations in number of mature individuals?	No

Extent and Occupancy Information

Estimated extent of occurrence Calculated (by COSEWIC Secretariat) as total area of Canadian Exclusive Economic Zone in Pacific Ocean.	597,695 km^2 (B.C. waters)
Index of area of occupancy (IAO) (2 km x 2 km grid) Calculated (by COSEWIC Secretariat) based on EO minus certain inlets along entire BC coast according to expert judgment of John Ford, DFO and SSC member. The Marine Mammals SSC concluded that although not calculated for the breeding grounds, which might be appropriate given the species' life cycle, the IAO for either the combined main breeding areas in Hawaii and Mexico or the combined migration corridors between those areas and B.C. would total >2000 km^2.	476,284 km^2 (B.C. waters)
Is the total population severely fragmented?	No
Number of "locations*" The primary breeding areas for the Humpback Whales that visit B.C. waters are in Hawaii and Mexico. There are at least 3 widely separated locations in Mexico: mainland, Baja California, and Revillagigedos Islands. Whales overwinter throughout the Hawaiian archipelago and it is difficult to determine how "Hawaii" could be subdivided into multiple locations. Some animals, instead of wintering in Hawaii or Mexico, migrate as far south as Central America or as far west as Japan. It should also be recognized that some reproductive activity (e.g., singing and possibly calving) takes place over a much broader area than only the generally recognized breeding areas. Also, there are multiple migration corridors.	Uncertain
Is there an observed, inferred, or projected continuing decline in extent of	No

* See definition of location.

occurrence?	
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	No
Is there an observed, inferred, or projected continuing decline in number of populations?	No
Is there an observed, inferred, or projected continuing decline in number of locations?	No
Is there a projected continuing decline in quality of habitat? Because of ship noise	Yes
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations*?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	**N Mature Individuals**
North Pacific (British Columbia)	~1,800 in 2006
Total	~1,800 in 2006

Quantitative Analysis

Probability of extinction in the wild is at least 20% within 20 years.	N/A

Threats (actual or imminent, to populations or habitats)

Individuals killed or seriously injured by vessel strikes and entanglement in fishing gear or debris
Disturbance in or displacement from feeding habitat – e.g., caused by anthropogenic noise
Habitat degradation in the breeding areas – e.g., caused by anthropogenic noise

Rescue Effect (immigration from outside Canada)

Status of outside population(s)?	Increasing
Is immigration known or possible?	Yes
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Likely
Is rescue from outside populations likely?	Yes

Current Status

COSEWIC: Threatened (May 2003)

* See definition of location.

Status and Reasons for Designation

Status:	**Alpha-numeric code:**
Special Concern	Not applicable
Reasons for designation: Although this recovering population is no longer considered to be Threatened, it is not yet secure. It was depleted by commercial whaling but has increased substantially since becoming legally protected from whaling in 1966. A basin-wide study in 2004-2006 resulted in an estimated abundance of 18,000 animals (not including first-year calves) in the North Pacific and an estimated rate of increase of 4.9 to 6.8%/year. Research conducted between 2004-06 indicated that about 2,145 whales (not including first-year calves) were present seasonally in British Columbia waters where they were increasing at around 4%/year. Current numbers are still considerably smaller than the minimum of 4,000 animals that must have been present off the west coast of Vancouver Island in 1905 given the numbers removed by whaling in the early 1900s. This population in the eastern North Pacific continues to face several threats including noise disturbance, habitat degradation (especially on the breeding grounds), entanglement in fishing gear or debris, and ship strikes.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable as there has been no evidence of decline since the 1960s when commercial whaling ended in the region. This population has been increasing at ca. 4%/yr since the early 1990s.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable.
Criterion C (Small and Declining Number of Mature Individuals): Not applicable. Although the number of mature individuals is less than 2,500, there is no evidence of a continuing decline.
Criterion D (Very Small or Restricted Total Population): Not applicable.
Criterion E (Quantitative Analysis): None available.

PREFACE

Since publication of the last COSEWIC Status Report on the Humpback Whale in 2003, new information about the status of the North Pacific population has become available and is provided in this report (the North Atlantic population is not updated here). The SPLASH project (Structure of Populations, Levels of Abundance, and Status of Humpbacks), a 3-year field effort from 2004 to 2006, was an international scientific collaboration with the goal of determining population size, population structure, and migration patterns of Humpback Whales throughout the North Pacific. SPLASH analyses resulted in an estimate of more than 18,000 non-calf Humpback Whales in the North Pacific. The SPLASH project increased understanding of migratory destinations and population structure. Genetic and other analyses from the project are ongoing. The first-ever abundance estimates for Pacific Canada indicate that more than 2,100 non-calf Humpback Whales feed in B.C. waters. Analyses of Fisheries and Oceans Canada's long-term dataset suggest that Humpback Whales in B.C. consist of two subpopulations, one in the north and one in the south, and that whales show strong site fidelity to local areas. A Recovery Potential Analysis has been developed for Humpback Whales in Pacific Canada and the Draft Recovery Strategy was expected to be completed in 2011.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2011)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

Environment Canada / Environnement Canada
Canadian Wildlife Service / Service canadien de la faune
Canada

The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

on the

Humpback Whale

Megaptera novaeangliae

North Pacific population

in Canada

2011

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and classification

Class: Mammalia
Order: Cetacea
Family: Balaenopteridae
Scientific Name: *Megaptera novaeangliae* Borowski, 1781

Known in English as Humpback Whale and in French as rorqual à bosse, *Megaptera novaeangliae* is the sole species in the genus. There are no recognized subspecies.

Morphological description

Humpback Whales are distinguished from other whales by their very long flippers, which may be as much as one third of the body length (True 1904). This feature gave rise to the Latin genus name, *Megaptera*, which means "large wings". Humpback Whales have a series of distinct bumps, or "tubercles" (remnant hair follicles) on the upper and lower jaw, and the leading edge of the flippers. The dorsal fin varies from rounded to falcate. As with other rorquals, Humpback Whales have 14-22 ventral throat grooves that allow them to take in large volumes of water for feeding (Leatherwood *et al.* 1976).

Humpback Whales reach lengths of 13 m for males and 14 m for females, with a maximum recorded length of 17.4 m (Chittleborough 1965). Adult mass is, on average, 34,000 kg, with a maximum of about 45,000 kg. Mean length at birth is 4.5 m and newborn calves weigh about 900-1,800 kg (Chittleborough 1965). Humpback Whales generally raise their tail flukes when diving, and the colouration pattern on the ventral surface, in combination with serrations along the trailing edge, is used to identify individuals (Katona and Whitehead 1981).

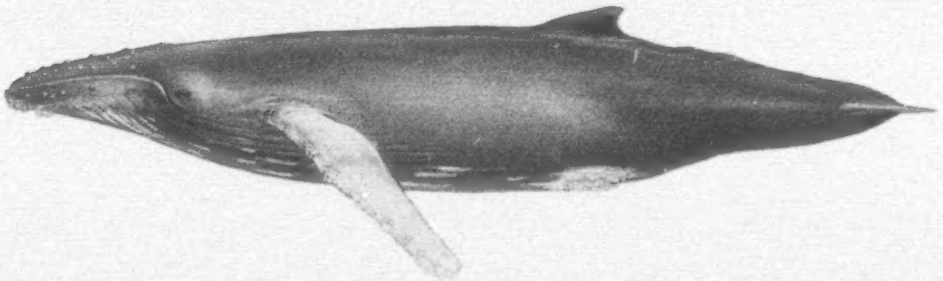

Figure 1. Humpback Whale. Illustration by A. Denbigh, courtesy of Fisheries and Oceans Canada.

Population spatial structure and variability

Genetic and sighting data indicate that Humpback Whales exhibit considerable fidelity to feeding areas, and this has led to the designation of a number of different stocks in the North Pacific (Nishiwaki 1966; Darling and Jurasz 1983; Baker *et al.* 1986; Perry *et al.* 1990; Calambokidis *et al.* 1996; Calambokidis *et al.* 1997; Baker *et al.* 1998; Urbán R. *et al.* 2000; Calambokidis *et al.* 2001; Angliss and Outlaw 2005; Carretta *et al.* 2007; Calambokidis *et al.* 2008). Differences in the migratory destinations of whales from the various feeding areas are also apparent. Baker *et al.* (1986) proposed that Humpback Whales in the eastern and central North Pacific constitute a single "structured stock" composed of geographically isolated "feeding herds" that merge on one or more breeding grounds. Within the U.S. Exclusive Economic Zone of the North Pacific, three "relatively separate populations" or "stocks" of Humpback Whales are recognized based on genetics and fidelity to summer/fall feeding areas (Carretta *et al.* 2007). The "western North Pacific stock" consists of whales that feed in the Aleutian Islands, Bering Sea, and Russia, the "California/Oregon/Washington stock" feeds along the west coast of the United States mainland, and the "Central North Pacific stock" feeds from Southeast Alaska to the Alaska Peninsula (Carretta *et al.* 2007). Humpback Whales in Pacific Canada have not been assigned to any of these stocks. However, based on photo-identification analysis, Calambokidis *et al.* (1996) suggested a demographic boundary between Humpback Whales feeding in Washington, Oregon, and California, and those feeding in British Columbia and Alaska.

The Humpback Whales that feed in British Columbia waters migrate to several different wintering grounds, primarily in Mexico (mainland and the offshore Revillagigedos Islands) and Hawaii but also to some extent the Ogasawara Islands, Japan (Darling and Jurasz 1983; Darling *et al.* 1996; Urbán R. *et al.* 2000; Calambokidis *et al.* 2001; Calambokidis *et al.* 2008) and at least occasionally, Central America. Rambeau (2008) used 16 years of photo-ID records (1992-2007) collected by Fisheries and Oceans Canada (DFO) and the SPLASH (Structure of Populations, Levels of Abundance, and Status of Humpbacks) project (Calambokidis *et al.* 2008) to examine population structure of Humpback Whales in B.C. In examining 217 whales that had been seen both in B.C. and in various North Pacific breeding areas, she found that whales photographed from central Vancouver Island northward (n=182) had a higher match rate to the Hawaii breeding ground (87%) than to the Mexico (13%) or Central America (0) breeding ground. In contrast, whales sighted off southwestern Vancouver Island (n=35) were more equally distributed between Hawaii (49%) and Mexico (46%), and in two cases were seen as far south as Central America. This apparent difference in breeding ground destinations between whales in the northern versus the southern part of B.C. adds support to the idea that Humpback Whales in B.C. waters may belong to two different subpopulations (Rambeau 2008). For the present assessment, however, all of the whales in British Columbia waters are considered a single population.

Designatable units

Humpback Whale populations in Canada are recognized as two designatable units (DUs) referred to as the "western North Atlantic population" and the "North Pacific population" respectively. This separation into two DUs is long-recognized and well-justified, as the North Atlantic and North Pacific populations are geographically isolated from each other, and have been for thousands of years (Baker *et al.* 1990). Humpback Whale populations in the North Atlantic and North Pacific thus meet the COSEWIC criteria for separate DUs on the basis of the populations being both discrete (belonging to different ocean basins, representing a natural disjunction of the species' geographic range) and significant (based on difference in mitochondrial DNA between the two oceans; Baker *et al.* 1990). Only the Pacific DU is considered in this update report. The Humpback Whales in Canadian Pacific waters represent part of the wider North Pacific population.

As mentioned in the previous section, future work that includes genetic and other analyses may provide a basis for recognizing multiple DUs in B.C. waters. The preliminary findings of differences in breeding ground destinations provide the basis for further investigation but are not sufficient to justify more than one DU at present.

Special significance

Humpback Whales were traditionally important to the culture and economy of coastal First Nations in B.C. For example, whaling directed at both Humpback Whales and Grey Whales (*Eschrichtius robustus*) was a feature among the Mowachaht, Hesquiaht, Otsosat, Ahousaht, and Tla-o-qui-aht (Drucker 1951). Success in whaling was a source of great individual prestige as well as cause for community celebration and sustenance (Drucker 1951; Arima 1983; Hendricks 2005).

At present, although Humpback Whales are not hunted, Nuu-chah-nulth communities continue to regard them as culturally significant (Hendricks 2005; Beach 2010). A few Nuu-chah-nulth members serve as whale watching guides and stranded whales are still of great interest to community members and chiefs, but mainly for their bones (used in art) rather than for their blubber (Beach 2010).

Of all the species of large whales, the Humpback Whale is considered the most acrobatic. Its nearshore distribution has made it one of the most accessible species of whales, and it is the focus of commercial and recreational whale watching in both summer feeding and winter breeding areas. Humpback Whales are well known for producing rich and varied "songs" (Payne and McVay 1971), which are thought to be a form of courting and mating display (Tyack 1981).

DISTRIBUTION

Global range

The Humpback Whale has a cosmopolitan distribution and occurs in tropical, temperate, and sub-polar waters (Figure 2). Calving in the North Pacific as a whole occurs in three areas: in the west from the northern Philippines to southern Japan, in the Hawaiian Islands, and in Mexico and Central America. Acoustic, sighting, and genetic data indicate that there is some movement of individuals between these breeding grounds (Payne and Guinee 1983; Baker *et al.* 1986; Helweg *et al.* 1990; Darling and Cerchio 1993; Darling *et al.* 1996; Calambokidis *et al.* 1997; Salden *et al.* 1999; Calambokidis *et al.* 2000; Calambokidis *et al.* 2001).

Canadian range

In Pacific waters, the range of Humpback Whales spans the inshore coastal inlets seaward across the continental shelf and into offshore waters. The extent of occurrence in western Canadian waters is thus close to 598,000 km^2. Canadian waters are used primarily for summer feeding from May to October. However, Humpback Whales can be observed in low numbers throughout the year (Rambeau 2008).

The index of area of occupancy in British Columbia waters was calculated as > 475,000 km^2. Given the life cycle of the species, it could be argued that it is more appropriate to use the combined area of its breeding range (all outside Canada) or alternatively the combined area of its migratory corridors (mostly outside Canada) as an index of area of occupancy. However, in either case such an index would considerably exceed 2,000 km^2, and therefore no attempt was made to calculate such an IAO.

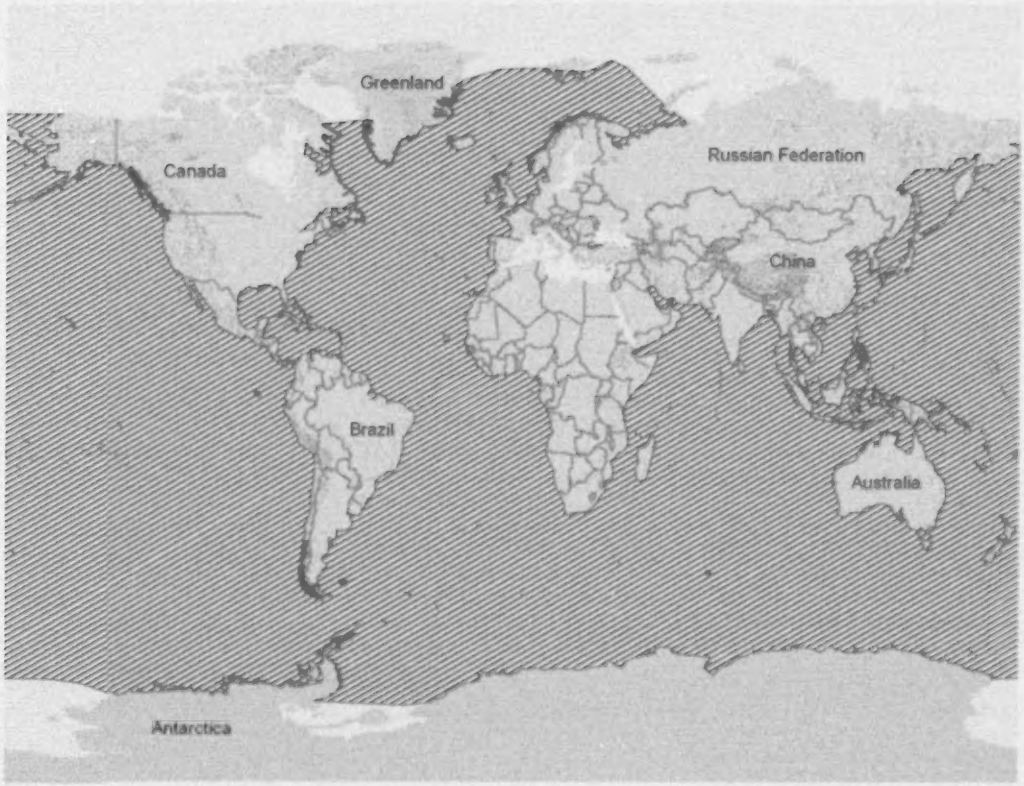

Figure 2. Global range of the Humpback Whale. Source: IUCN (www.iucnredlist.org).

It is uncertain whether more than one location (COSEWIC terminology) should be identified for this species. The primary breeding areas for the Humpback Whales that visit B.C. waters are in Hawaii and Mexico. There are at least 3 widely separated locations in Mexico: mainland, Baja California, and Revillagigedos Islands. Whales overwinter throughout the Hawaiian archipelago and it is difficult to determine how "Hawaii" could be subdivided into multiple locations. Some animals, instead of wintering in Hawaii or Mexico, migrate as far south as Central America or as far west as Japan. It should also be recognized that some reproductive activity (e.g., singing and possibly calving) takes place over a much broader area than only the generally recognized breeding areas. Also, there are multiple migration corridors.

Search effort

In 1984, DFO established a photo-identification program to catalogue sightings of individual Humpback Whales in B.C. waters. Photographs were collected using three approaches: 1) 1984-2006: photographs were collected opportunistically and/or provided to DFO by individuals and external research groups, 2) 2002-2006: DFO collected photographs during multi-purpose/multi-species cetacean surveys, and 3) 2004-2005: DFO conducted Humpback Whale-targeted photo-ID surveys as part of the SPLASH project. As of 2006, the photographic database consisted of 8,900 records of Humpback Whale sightings in B.C.

Other records of Humpback Whales in B.C. include: 1) sighting records collected by DFO during coast-wide cetacean surveys, 2) opportunistic sightings reported to and collected by the BC Cetacean Sightings Network (BCCSN) (www.wildwhales.org), 3) systematic marine mammal surveys of B.C. coastal waters conducted by Raincoast Conservation Foundation (www.raincoast.org) (Williams and Thomas 2007), and 4) photo-identification data collected in targeted areas of the coast by non-profit research organizations such as Cetacealab (www.whaleresearch.ca) and Pacific Wildlife Foundation (www.pwlf.org).

HABITAT

Habitat requirements

Humpback Whales use productive waters at high latitudes for feeding. Courting, mating, calving, and at least the early phases of nursing take place in warm temperate and tropical waters, although some non-breeding females may remain on feeding grounds throughout the winter (Straley 1990; Clapham *et al.* 1993; Brown *et al.* 1995).

The Humpback Whale is a coastal species, but also uses offshore waters during migration and was taken by whalers in the deep waters beyond the continental shelf (Ford *et al.* 2009). British Columbia's coastal inlets and shelf waters provide productive feeding habitat (Ware and Thomson 2005) and likely also act as migratory routes for Humpback Whales traveling to Alaska to feed (Gregr and Trites 2001; Rambeau 2008).

Humpback Whales fast during migration and on the breeding grounds (Chittleborough 1965). The waters off B.C. serve as important feeding habitat from May to December (Gregr *et al.* 2000; Rambeau 2008) when the whales build up fat reserves to sustain them during migration and while on their breeding grounds (Chittleborough 1965; Baraff *et al.* 1991).

Habitat trends

Describing habitat changes over time for a migratory, pelagic species is difficult. There has been no documented change in the quantity of Humpback Whale habitat in the North Pacific, although the quality of habitat may be declining due to increases in physical and acoustic disturbance (National Research Council 2003), and possible changes in prey distribution and/or abundance. Localized changes in habitat quality may alter Humpback Whale spatial distribution in the region but not necessarily reduce the total amount of habitat available. It is assumed that should prey distribution in B.C. change, this would be reflected in a parallel shift in Humpback Whale distribution, as has been seen in studies in the western North Atlantic where shifts in the local occurrence of both Humpback Whales and Fin Whales (*Balaenoptera physalus*) have correlated with fluctuations in fishery catches (and presumably stock levels) of American Sandlance (*Ammodytes americanus*) (Payne *et al.* 1990) and Capelin (*Mallotus villosus*) (Whitehead and Carscadden 1985; Piatt *et al.* 1989). Individual Humpback Whales often show considerable fidelity to particular feeding locations, to which they return annually (Clapham and Mead 1999; Rambeau 2008). This fidelity may well have constrained re-colonization of former habitat in B.C. waters, although Humpback Whales are observed regularly in most areas of the province known to be of historical importance (Ford *et al.* 2009).

Concern has been expressed about declining habitat quality in the Hawaii breeding grounds (e.g., due to localized input from sewage injection wells), but currently the habitat in Hawaii is considered to be in good condition for Humpback Whales. Potential future threats, such as increases in coastal pollution and offshore development of aquaculture and alternate energy structures, need to be monitored (Mattila 2010).

BIOLOGY

Life cycle and reproduction

Humpback Whale breeding is seasonal, and in the North Pacific, extends from approximately November or December to May (Baker and Herman 1981; Urbán and Aguayo 1987). Although copulation has never been observed, mating-related activities are seen during this period (e.g., males escorting females and sequestering them from other males). Courting and mating by North Pacific Humpback Whales takes place mostly on tropical and sub-tropical wintering grounds in the coastal waters of the Hawaiian Islands, Mexico, Central America, Japan, and the Philippines (Calambokidis *et al.* 2008). Gestation lasts 11-12 months, with one offspring per pregnancy (Chittleborough 1958). Calving occurs on the wintering grounds between December and April (Nishiwaki 1959; Herman and Antinoja 1977; Whitehead 1981). Females give birth every one to five years, with two or three-year calving intervals being the most common (Clapham and Mayo 1990; Weinrich *et al.* 1993; Straley *et al.* 1994). Estimates of calving rate vary considerably between SE Alaska (0.37–0.50 calves/year per female; Baker *et al.* 1987; Straley 1994) and Hawaii (0.44–0.73 calves/year per female; Baker

et al. 1987; Craig and Herman 1997; Glockner-Ferrari and Ferrari 1997). Some calves stay with their mother for 2 years (Clapham 1992), but most are weaned at less than a year (Chittleborough 1958; Baraff and Weinrich 1993).

Both sexes reach sexual maturity at between 5 and 9 years of age, at a length of about 12m (Chittleborough 1965; Johnson and Wolman 1984; Clapham 1992). Average longevity of Humpback Whales is unknown but the oldest Humpback Whale taken by whalers was estimated at 48 years based on counts of layers in waxy earplugs (Chittleborough 1965). By the time of Chittleborough's study, however, the largest and oldest individuals likely had been removed, so 48 years should be regarded as a minimum age attainable. Moreover, present-day understanding of growth layer counting would suggest that true maximum longevity is at least 80 and perhaps close to 100 years (Clapham 2011).

The generation time (average age of parents in the current cohort) is estimated to be 21.5 years under pre-disturbance conditions with an assumed stable population, following Taylor *et al.* (2007), who used a 5-parameter demographic model designed to obtain "default" estimates of generation length and percent mature for IUCN assessments. Higher estimates of longevity as mentioned in the preceding paragraph could lead to considerably higher estimates of generation time for this species.

Physiology and adaptability

Humpback Whales are able to tolerate a wide range of ocean temperatures associated with their high-latitude feeding areas, which are often near ice-covered waters in both northern and southern hemispheres, and their tropical to subtropical breeding areas. Humpback Whale migrations to and from winter breeding areas are among the longest of any mammal, and little if any feeding takes place during migration (Clapham and Mead 1999).

Of all the baleen whales, Humpback Whales may be the most versatile with regard to their feeding techniques. Like all rorquals, Humpback Whales are "gulp feeders", expanding their throat pleats to engulf discrete mouthfuls of food. Specific Humpback Whale feeding behaviours include lunge feeding, flick feeding, and bubble netting. Bubble netting, unique to Humpbacks, is a cooperative feeding technique used to trap or confuse fish and other small prey (Sharpe 2001). The whales encircle their prey in a cylinder of bubbles, and then swim up through the centre with mouths wide open, engulfing the prey. This may be performed by individual whales or by groups of 15 or more whales (Leighton *et al.* 2004).

Dispersal and migration

Humpback Whales migrate between tropical low-latitude winter breeding grounds (10°-23° latitude in both hemispheres) and temperate high-latitude summer feeding grounds (35°-65°) (Chittleborough 1965; Baker *et al.* 1986; Katona and Beard 1990). There is some debate over the reason behind such an extensive migration. Possible explanations include avoiding predation on calves in high-latitude areas (Corkeron and Connor 1999; Connor and Corkeron 2001) and the potential increases in reproductive success gained later in life by calves that are born in warm waters (i.e., that can devote more energy to growth and development; Clapham 2001).

Although exact migratory routes are uncertain (Mate *et al.* 1998; Norris *et al.* 1999), the migration can be both rapid (Gabriele 1996) and direct (Mate *et al.* 1998) with timing staggered based on age class and sex. There is some evidence that while most individuals move to the breeding grounds, some animals remain in middle and high latitudes, presumably feeding, until well into the breeding season (Straley 1990; Swingle *et al.* 1993; Brown *et al.* 1995; Craig and Herman 1997; Laerm *et al.* 1997; Barco *et al.* 2002).

Differences in the timing of breeding as well as pigmentation differences suggest that populations of Humpback Whales in the northern and southern hemisphere are reproductively isolated (Pike 1953; Rosenbaum *et al.* 1995). Some North Pacific and South Pacific Humpback Whales overwinter in the same tropical breeding areas (Stone *et al.* 1990; Acevedo and Smultea 1995; Flórez-González *et al.* 1998) so there is potential for genetic mixing (Baker *et al.* 1993). However, their use of such areas is temporally out of phase. Genetic data suggest one or two migrants between ocean basins per generation (Baker and Palumbi 1997).

Interspecific interactions

Humpback Whales in the North Pacific feed on a highly variable diet that consists of crustacean zooplankton (particularly euphausiids and copepods) and small schooling fishes such as Pacific Herring (*Clupea pallasi*), Capelin, Sandlance, Pacific Sardine (*Sardinops sagax*), juvenile salmonids (*Oncorhynchus* spp.), Pacific Cod (*Gadus macrocephalus*), Mackerel (*Pleurogrammus monopterygius*), and Anchovy (*Engraulis mordax*), in addition to pteropods and some cephalopods (Johnson and Wolman 1984).

An examination of stomach contents of Humpback Whales taken by whalers in B.C. between 1949 and 1965 showed that euphausiids were by far the most common prey (Ford *et al.* 2009; CRP-PBS unpubl. data). Out of 287 stomachs containing food remains, 263 (92%) had only krill (two species: *Thysanoessa spinifera* and *Euphausia pacifica*), 12 (4%) had only copepods, and 2 (0.7%) had only fish. The remaining stomachs contained mixtures of the three, and one contained only small squid (Ford *et al.* 2009; CRP-PBS unpubl. data). Similar observations have been made in Frederick Sound, Alaska, where the two krill species *T. raschi* and *E. pacifica* made up 50-80% of the Humpback Whales' diet (Dolphin 1987). Foraging Humpback Whales in southeast Alaska feed on euphausiid swarms with densities of at least 50 euphausiids/m^3 at depths of up to 120 m (Dolphin 1987).

The zooplankton community in B.C. is dominated by small to medium-sized copepods (*Calanus*, *Neocalanus*, *Acartia* and *Oithona*) in the spring, whereas peaks in euphausiid biomass (*Euphausia* and *Thysanoessa*) occur from late summer to early winter. High biomasses of euphausiids are frequently found over steep slopes in the sea floor. Copepods, euphausiids, ctenophores, and barnacle larvae are the most abundant zooplankton found in B.C. inlets. Prey sampling and observations of feeding conducted in B.C. waters between 2002 and 2007 identified euphausiids as the primary prey. However, these observations also suggested that schooling fishes (Pacific Herring, Sandlance and Pacific Sardine) are far more important than the whaling records suggest, especially in nearshore waters (Ford *et al.* 2009; CRP-PBS unpubl. data).

POPULATION SIZES AND TRENDS

Sampling effort and methods

Abundance estimates specific to B.C. were developed using mark-recapture analyses of DFO's Humpback Whale photo-identification catalogue (see **DISTRIBUTION: Search effort**). A detailed review of assumptions and biases associated with these mark-recapture estimates, and an examination of multiple models for B.C. was performed by Rambeau (2008). To estimate abundance Rambeau (2008) used photo-identification records collected from May-September 1992-2006, and developed a proxy for effort using the total number of days that photographs were taken per year. Although this index does not account for hours spent searching per day, or for effort invested in "whale-free" regions, a relative index of overall "effort days" per year was achieved. This index of effort was then incorporated into one of the mark-recapture models for estimating abundance (Jolly-Seber), correcting some of the positive bias introduced by increased temporal and spatial effort.

Abundance

There are no rigorous pre-commercial whaling population estimates for Humpback Whales in the North Pacific. Although Rice (1978) concluded that catches by shore whalers along the California coast had been negligible, a recent analysis estimated that more than 1,600 Humpback Whales were removed by those whalers between 1854 and 1900 (Reeves and Smith 2010). Noting that some 28,000 had been killed by whalers (both ship-based and shore-based) in the North Pacific between 1905 and 1965, Rice (1978) estimated that there were on the order of 15,000 Humpbacks throughout the basin during the first years of the 20th century. He considered this figure to be "... roughly consistent with the catch statistics and with our knowledge of the population dynamics of baleen whales."

Based on a photo-identification study from 2004-2006, the best recent estimate of abundance for the North Pacific is 18,302 excluding calves (taken as an average of the estimated abundance for wintering areas, 17,558, and feeding areas, 19,056; Calambokidis *et al.* 2008). There are no rigorous estimates of abundance prior to this.

Williams and Thomas (2007) conducted cetacean line transect surveys throughout many of B.C.'s inner coastal waters in 2004 and 2005, and produced an abundance estimate of 1,310 Humpback Whales (95% confidence limits, 755-2,280). This estimate is presumably negatively biased because survey coverage did not include waters off the west coasts of Vancouver Island or the Queen Charlotte Islands. Recent photo-identification studies of Humpback Whales sighted in BC from 1992-2006 produced abundance estimates ranging from 1,428 to 3,856 (across a range of models). The best estimate for 2006 was considered to be 2,145 (95% credibility set: 1,970-2,331) based on a Jolly-Seber model that factored in effort (Rambeau 2008). This estimate did not consider calves, but would have included whales that were not yet sexually mature. It is likely an underestimate, but the model that produced the value of 3,856 would likely overestimate abundance. Using the value of 2,145 non-calves, and assuming an adult survival rate of 97.6% (BC Humpback Whales; Rambeau 2008) and an age at sexual maturity of 9 years, the total number of mature individuals in B.C. can be estimated as approximately 1,800.

Whaling for Humpback Whales in B.C. was prohibited after 1965. Between 1908 and 1965 at least 5,638 were killed, of which nearly 4,000 were taken in the first 10 years (1908-1917), with a 1-year maximum of 1,022 in 1911 (Gregr *et al.* 2000). The total reported catch from 1942 through 1965 was 826. The timeframe from 1942 to 2006, the year of the most recent abundance estimate, represents approximately 3 generations, assuming a generation time of 21.5 years under pre-disturbance conditions with an assumed stable population (Taylor *et al.* 2007). Based on B.C.'s commercial whaling records and hindcasting of minimum abundances off the west coast of Vancouver Island, Ford *et al.* (2009) suggested that although the Humpback Whale population in Pacific Canada is increasing, numbers remain below pre-commercial whaling levels (i.e., pre-1908).

Fluctuations and trends

Commercial whaling had seriously depleted all populations of Humpback Whales before the species was given legal protection in the North Pacific in 1966. The consensus of scientific opinion (as summarized in the IUCN Red List documentation for the Humpback Whale) is that numbers throughout the basin have been increasing but that recovery is not yet complete (Reilly *et al.* 2008).

Judging by the pattern of catches in B.C. (Figure 3) it appears that the local availability of Humpback Whales had declined dramatically by about 1915, and it is reasonable to assume that this reflected a greatly reduced population in the region. Commercial shore whaling in B.C. continued almost without interruption until the Second World War, with Humpbacks remaining as a much smaller proportion of the total whale catch than had been the case prior to 1915. The obvious "switch" in catch predominance from Humpback Whales and Blue Whales (*Balaenoptera musculus*) in the early years to Fin Whales, Sperm Whales (*Physeter macrocephalus*), and Sei Whales (*B. borealis*) in later years was attributed by Gregr *et al.* (2000) to "serial depletion," which they considered mainly "a function of the relative profitability and ease of capture" of the various species.

Indirect evidence of population trend over the last three generations (i.e., since 1946) comes from catch records at the Coal Harbour whaling station on Vancouver Island that began operating in 1948 (Nichol *et al.* 2002). Initially (1948-1953), 20% of the catch was Humpbacks. This percentage declined to 7% from 1954 through 1959 and to only 2% from 1962 through 1965 (the station did not operate in 1960 and 1961 and it closed after the 1967 whaling season). A crude, imprecise estimate of 1,400 (1,200-1,600) for the total North Pacific population in the mid-1970s was based on Japanese sightings data (Gambell 1976). Although no trend data are available from 1966 to the 1990s, there has been a general increase in abundance in recent years and it is reasonable to assume that this increasing trend has been ongoing for several decades.

The most recent estimates of annual rate of increase for the North Pacific Humpback population range from 4.9 to 6.8%, depending on the method used and the timeline considered, and based on photo-identification data from 2004 to 2006 (Calambokidis *et al.* 2008). Effort-corrected estimates for Humpback Whales in BC based on photo-identification data from 1992 to 2006 indicated an average annual rate of increase of 4.1% in 2006 (Rambeau 2008). These rates of increase refer to estimates of non-calves; no attempt has been made to calculate separate rates of increase for the mature component of the population (either basin-wide or B.C. only).

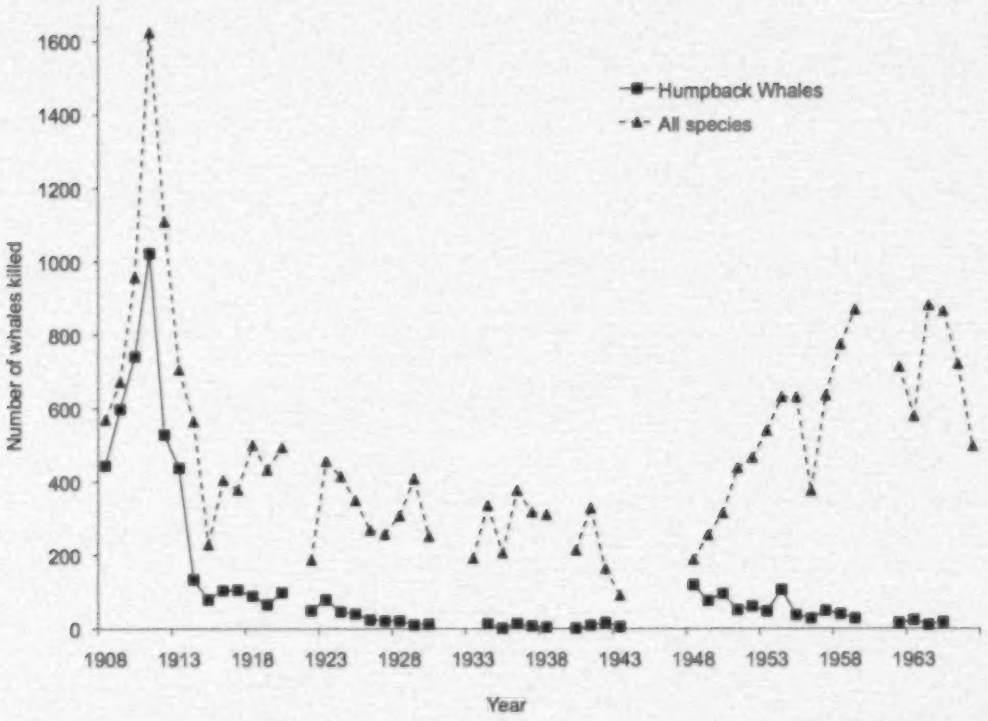

Figure 3. Reported catches of Humpback Whales versus all whale species at whaling stations in BC, 1908-1967. Data from Nichol *et al.* (2002).

Rescue effect

Humpback Whales in B.C. have considerable interchange with populations to the north and south (i.e., whales that frequent Canadian waters are regularly seen in the U.S. and vice versa). Whales migrating to southeast Alaska likely pass through B.C., making some degree of rescue possible.

THREATS AND LIMITING FACTORS

Threats

Threats to individual Humpback Whales in Canadian Pacific waters include vessel strikes, entanglement, and disturbance or displacement (usually temporary) due to underwater noise. Threats that are less regular or less well documented include toxic spills, persistent bioaccumulating toxins, biotoxins, and physical displacement (generally at least quasi-permanent as a result of habitat alteration). Cumulative effects of all of these factors could be important (Whitehead *et al.* 2000).

Vessel strikes

Humpback Whales tend to occupy coastal and shelf-break areas where they frequently encounter large and small vessel traffic. Globally, the Humpback Whale is the second most commonly reported struck species of whale (after the Fin Whale) (Jensen and Silber 2003). Apparently, a high proportion of struck Humpback Whales are calves or juveniles. Strike risk is greatest in shipping lanes and in areas where vessels are travelling at 14 knots (26km/hr) or faster (Laist *et al.* 2001).

In B.C., Humpback Whales are the most commonly reported cetaceans struck by vessels. The DFO Marine Mammal Response Program in B.C. received 21 confirmed strike reports involving Humpback Whales between 2001 and 2008 (Ford *et al.* 2009). These incidents occurred at many different locations along the coast. Commercial and recreational boat traffic has increased dramatically in recent years and is expected to continue to increase. As vessels get larger, faster, and more frequent, and as the whale population grows, the number of strikes on Humpback Whales is certain to increase. Monitoring vessel strikes is difficult. There are no confirmed incidents of Humpback Whales being struck by cargo vessels, ferries, or cruise ships in B.C. However, because strikes by large vessels sometimes go unnoticed by the crew, the incidence of ship strikes may be higher than reported.

A representative of the Uu-a-thluk (Nuu-chah-nulth Tribal Council Fisheries) reported that although she was not aware of vessel strikes on Humpback Whales, she had observed two "near hits" over the last two years (Beach 2010).

Entanglement

Entanglement is a major cause of injury and mortality of marine mammals, including Humpback Whales (Volgenau *et al.* 1995; Clapham and Mead 1999; Johnson *et al.* 2005). The coastal distribution of Humpback Whales during feeding and migration means they occur in areas of intense fishing and aquaculture activities. This makes them particularly vulnerable to entanglement. Entanglements are not always immediately fatal, but they can cause serious wounds or result in amputations or mutilations that affect survival and reproductive fitness.

Incidents of Humpback Whale entanglement in the North Pacific have been documented on winter breeding and summer foraging grounds (Mazzuca *et al.* 1998; Neilson *et al.* 2007). In B.C., 40 Humpback Whale entanglements have been reported since 1987, four of which resulted in confirmed deaths (Ford *et al.* 2009). Various gear types were involved in these entanglements, including gillnets, traps, herring pond structures, aquaculture gear, longline gear, seine nets, and anchor lines (Ford *et al.* 2009). In some regions, rates of reported entanglement are considered to be far below the actual rates (Robbins *et al.* 2009). An analysis of scarring on Humpback Whales in southeast Alaska indicated that 52% of photographed individuals bore evidence of entanglement (Neilson *et al.* 2007).

Noise

Humpback Whales produce low frequency vocalizations and have greatest predicted hearing sensitivity in the range of tens of Hz to 10 kHz, although they may be able to detect and produce signals with harmonics extending up to 24 kHz (Au *et al.* 2006; Southall *et al.* 2007). Commercial shipping is a major contributor of underwater noise at low frequencies (5 to 500 Hz). Other sources of high-intensity underwater noise include seismic exploration, military sonar, oceanographic experiments, and industrial activities. Between 1950 and 2000, ambient low frequency noise in the oceans increased by an average of 16 dB (National Research Council 2003). Because an increase of 3 dB corresponds to a doubling of noise power, 16 dB represents a doubling of noise power each decade. Both acute and chronic ocean noise levels are expected to continue to rise (National Research Council 2005).

Although it is difficult to measure impact, there is evidence that Humpback Whales can be disturbed and displaced by underwater noise (Richardson *et al.* 1995). Reactions to underwater noise may include avoidance, interruption of feeding, moving away from the sound source, and changes in respiration and dive patterns (Anon. 2005; Frankel and Clark 2000; McCauley *et al.* 2000; Stone and Tasker 2006). In Hawaii, singing Humpback Whales exposed to military low frequency active sonar increased the length of song, perhaps in response to masking effects of the sonar signals (Miller *et al.* 2000; Fristrup *et al.* 2003). Two Humpback Whales that died following exposure to underwater blasting sounds in Newfoundland exhibited inner ear damage (Ketten *et al.* 1993).

The effects of acoustic disturbance may be greater when combined with other threats. Todd *et al.* (1995) found that although there was no detectable change in behaviour or distribution of Humpback Whales exposed to underwater explosions, there was a coincident increase in the incidence of local entanglements. They speculated that the high-intensity underwater sounds affected the ability of some whales to orient and navigate around obstacles.

Noise may mask communication signals used in breeding or socializing (Miller *et al.* 2000; Fristrup *et al.* 2003; Parks and Clark 2007) and it may interfere with prey detection or predator avoidance. Such effects could have larger consequences than short-term behavioural responses suggest. The links, if any, between short-term behavioural responses and longer-term population impacts remain unknown (National Research Council 2005).

Pollution

Acute exposure to pollutants (e.g., oil spills) may have severe and immediate effects on individuals or a population. Future increases in oil development and transportation in coastal B.C. represent an increased potential for toxic exposure. For example, Enbridge Northern Gateway Pipelines has announced plans to file a regulatory application to build a twin pipeline system that would connect Edmonton, Alberta with a marine terminal in Kitimat, B.C. (www.northerngateway.ca). The Northern Gateway Project would result in tankers going directly through one of the four areas proposed by DFO as critical habitat for Humpback Whales (Nichol *et al.* 2010). If approved, construction of the pipeline could begin as early as 2012, and very large crude carriers (oil tankers) would transport petroleum from Kitimat via Douglas Channel to Hecate Strait and from there through Queen Charlotte Sound or Dixon Entrance. This would increase the risk of a major oil spill in B.C. waters and thereby the potential threat to Humpback Whales from exposure to hydrocarbons.

Concern has been expressed about declining habitat quality in the Hawaii breeding grounds (e.g., due to localized input from sewage injection wells), but currently the habitat in Hawaii is considered to be in good condition for Humpback Whales. Potential future threats, such as increases in coastal pollution and offshore development of aquaculture and alternate energy structures, need to be monitored (Mattila 2010).

Limiting factors

Humpback Whales are long-lived animals with a varied prey base and a demonstrated ability to recover from population depletion (described by Clapham *et al.* (1999) as "a remarkably resilient species"). Mean annual rates of increase for humpback whale populations that have been adequately monitored are in the range of 7 to 9% (Zerbini *et al.* 2010).

Natural mortality

In B.C. and elsewhere in the North Pacific, known or potential causes of natural mortality include predation, disease, biotoxins, and (rarely) accidental beaching (Baird 2003). The annual migrations undertaken by Humpback Whales are energetically costly and expose cow-calf pairs to predation risk. Based on records of predation events (Jefferson *et al.* 1991; Florez-Gonzalez *et al.* 1994), and scarring prevalence (Steiger *et al.* 2008), predation by Killer Whales (*Orcinus orca*) in breeding areas may be a significant cause of juvenile mortality. False Killer Whales (*Pseudorca crassidens*) harass Humpback Whales (Weller 2009) and there is an unconfirmed report of a calf being killed by these whales (Hoyt 1983). Large sharks may prey on calves (Glockner-Ferrari and Ferrari 1997; Mazzuca *et al.* 1998) although such events appear to be infrequent. Little is known about diseases in Humpback Whales.

Site fidelity

The strong site fidelity that Humpback Whales show to traditional feeding grounds (North Pacific: Darling and McSweeney 1985; Baker *et al.* 1986; Craig and Herman 1997; see **Population spatial structure and variability**) is believed to be maternally directed. In other words, whales are likely to return to feeding areas first visited with their mothers. In a study of Humpbacks photo-identified in B.C. over multiple years, more than half (57%) of the returning whales observed (n=585) were seen within 100 km of their sighting location from previous years (Rambeau 2008). Such fixation on particular feeding (and breeding) areas is likely to constrain the rate or pattern of habitat re-occupation once Humpback Whales have been extirpated from an area. Nonetheless, as noted under **Habitat trends**, they are currently found in most areas of the province where they were seen regularly in the past, including those from which they had disappeared after a period of intensive whaling (Ford et al. 2009).

PROTECTION, STATUS, AND RANKS

In Canada, the Pacific population of Humpback Whales is listed on Schedule 1 of SARA as Threatened (the Atlantic population was last assessed in May 2003 as Not at Risk).

Legal protection and status

The Humpback Whale is legally protected under two international conventions. The International Convention for the Regulation of Whaling 1946 (administered by the International Whaling Commission - IWC) banned the commercial hunting of Humpback Whales in the North Atlantic in 1955 and in the North Pacific in 1966 (Best 1993). The Humpback Whale has not been subject to commercial hunting in Canada since 1966 even though Canada withdrew from the whaling convention in 1982. Commercial trade in Humpback Whale parts or products is banned as the species is listed in Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

In Canada, DFO is responsible for the management of Humpback Whales and other cetaceans. Cetaceans are legally protected by the Marine Mammal Regulations under the *Fisheries Act*, 1985. These regulations make it an offence to kill, harm, or harass marine mammals (S. 7, 8, 9, 11). COSEWIC previously assessed the North Atlantic population as Threatened in 2003; additional protection is afforded to Pacific Humpback Whales by *SARA* (Section 32(1)) as they are on Schedule 1. As required under *SARA*, a formal Recovery Strategy is being developed. Regional Public Consultation on a draft was completed in May 2010.

Protective measures in other countries that are visited by North Pacific Humpback Whales are also relevant. In the United States, Humpback Whales are managed and legally protected under an array of laws, including the *Marine Mammal Protection Act* of 1972, the *Endangered Species Act* of 1973 (under which they are currently listed as Endangered), the *Marine Protection, Research and Sanctuaries Act* of 1974 (for whales in the Hawaiian Islands Humpback Whale National Marine Sanctuary and other relevant sanctuaries), as well as various federal and state-specific regulations. In Mexico, Humpback Whales (and other large whales) are fully protected under several statutes. The species is listed as Endangered under Mexican Standard NOM-059-ECOL-2001 and a species conservation action program is being developed (Rojas-Bracho 2010). No North Pacific nation currently conducts whaling operations targeting Humpback Whales.

Non-legal status and ranks

The Humpback Whale has been assigned a NatureServe global conservation status rank of G4 (Apparently Secure) and a national status rank of N3 (Vulnerable) in both Canada and the United States. The Pacific population has been assigned a subnational rank in B.C. of S3 (Vulnerable) (NatureServe 2009). The most recent (2005) Canada General Status Rank is 4 (Secure) in Canada (CESCC 2006). This rank is subdivided between the Atlantic population (4 – Secure) and the Pacific population (1 – At Risk). Note that a COSEWIC designation of Endangered or Threatened automatically results in a Canada General Status Rank of At Risk (CESCC 2006). The Humpback Whale has been assessed by IUCN as Least Concern (Reilly *et al.* 2008). It is on the Province of British Columbia's Blue List (for species that are considered Special Concern) (BC Conservation Data Centre 2008).

In B.C., DFO, in collaboration with many other organizations, has developed the "Be Whale Wise: Marine Wildlife Guidelines for Boaters, Paddlers and Viewers" (DFO 2008) to limit physical and acoustic disturbance.

Habitat protection and ownership

The *Fisheries Act* contains provisions that can be applied to regulate the pollution of fish-bearing waters, and harmful alteration, disruption and destruction of fish habitat, which extends to the habitat of marine mammals. Under *SARA*, there is a further requirement to identify critical habitat (Section 41, 1(c)), identify measures to prevent the destruction of critical habitat (s. 58), and identify steps to reduce risk of harm to individuals outside of critical habitat (s. 32). Critical habitat has not yet been determined for Humpback Whales, but it is being considered as part of the development of the Recovery Strategy. A report documenting the information relevant to the identification of critical habitat has been completed (Nichol *et al.* 2010). The *Oceans Act*, 1997, provides for the establishment of marine protected areas (MPAs) in federal waters and one of the listed justifications for establishment of an MPA is the conservation and protection of marine mammals and their habitat (Section 35, 1 (a)). In June 2010 Parks Canada established the Gwaii Haanas National Marine Conservation Area Reserve, which

provides special protection for a marine area of approximately 3,400 km^2 around the Gwaii Haanas National Park Reserve and Haida Heritage Site. This area has been identified as a primary feeding habitat for Humpback Whales in western Canadian waters (Nichol *et al.* 2010).

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BIOGRAPHICAL SUMMARY OF REPORT WRITER

Andrea Rambeau received her MSc. in Zoology from the University of British Columbia in 2008 under the supervision of Dr. John Ford and Dr. Andrew Trites. Her thesis focused on filling in critical knowledge gaps concerning the population structure and abundance of Humpback Whales in British Columbia. Before her master's, Andrea spent two years with the Cetacean Research Program at DFO's Pacific Biological Station in Nanaimo, where she focused on Humpback Whale photo-identification studies. Since then, she has co-authored An Assessment of the Potential for Recovery of Humpback Whales off the Pacific Coast of Canada, worked as an Advisor to the Humpback Whale Recovery Team, presented technical findings from her master's at workshops and meetings, and co-authored the Draft Humpback Whale Recovery Strategy. Ms. Rambeau has extensive experience (>250 days) conducting marine mammal surveys in inshore and offshore waters and in determining abundance, distribution, and stock structure of wildlife populations in Canada. She has used her broad knowledge of Pacific ecosystems and species to instruct college courses and to provide natural history presentations to the public. Her current work as an environmental consultant focuses on developing environmental impact assessments, in particular as they apply to marine species and species at risk.

COLLECTIONS EXAMINED

The Cetacean Research Program at the Pacific Biological Station, Fisheries and Oceans Canada provided the data used to calculate EO and AO. No biological collections were examined.